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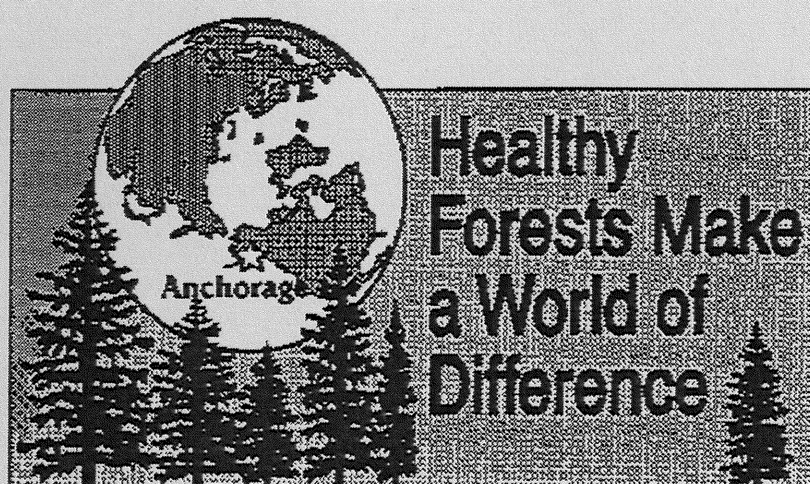
# FOREST HEALTH PROTECTION REPORT

## *Ips perturbatus*; A Pest of ManagedStands??

***1998 Update***




**Biological Evaluation-77**
**November 1998**

# *Ips perturbatus*; A Pest of Managed Stands?

## *1998 Update*

BIOLOGICAL EVALUATION R10-TP-77

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## INTRODUCTION

After more than a decade of increasing spruce bark beetle (*Dendroctonus rufipennis*) activity in Alaska; infestations are currently declining (Matthews 1997). Approximately 300,000 acres of active and on-going infestations were detected in 1998; a significant reduction from the more than 1,000,000 acres of on-going and new infestations detected in 1996. Approximately 2.5 million acres have been impacted by the spruce beetle in the last decade. Spruce bark beetle outbreaks are commonly encountered in south-central Alaska; less so in southeast Alaska's maritime Sitka spruce forests and interior Alaska's white spruce forests. The spruce beetle **is** the major forest pest of spruce. However, other bark beetles, specifically *Ips perturbatus*, are also tree killers of spruce, especially in interior Alaska's white spruce forests (Bright 1976, Furniss and Carolin 1977, Holsten et al. 1985). *I. perturbatus* is very similar to the European spruce beetle, *I. typographus* (Wood 1982). *I. typographus* is the most devastating bark beetle of European conifer forests; much more so than the North American species of *Ips*. *Ips* -caused mortality of white spruce has been recorded from interior Alaska since the 1950's (Holsten and Hard 1986). At times, scattered, but intense, *Ips* activity has encompassed more than 1,500 square miles. Most previous *Ips* outbreaks have developed from logging slash, fire stressed, and flood weakened trees. Limited *Ips* - caused spruce mortality, however, has been previously noted in south-central Alaska (Holsten 1996).

In the winter of 1995/6, the Chugach National Forest partially harvested areas near the Granite Creek Campground (Kenai Peninsula, AK). The objective of the harvesting was to remove spruce beetle killed or currently infested trees while retaining a residual stand of smaller spruce. These smaller diameter spruce would be at lower risk to future spruce beetle-caused mortality. Due to aesthetic concerns, essentially all slash from the harvesting operation had been removed. Throughout the spring and summer of 1996, however, it became apparent that some of the residual spruce throughout the harvested areas near the entrance to the Granite Creek Campground (Chugach National Forest, Kenai Peninsula) were chlorotic. Foliage fading, an indication of beetle infested trees, became apparent by July of 1996, with the crowns of many smaller spruce turning a reddish brown in color. A brief site visit in late July indicated that some of these affected trees had been attacked by spruce beetles, but many more had been attacked by *Ips* sp. The species determination, *I. perturbatus*, was made in 1997.

In September 1996, Forest Health Protection (FHP) personnel conducted a strip-cruise of the affected area (Holsten 1996). Results of this evaluation demonstrated that 11.5% and 5.5% of the residual spruce were attacked and killed by *Ips* and spruce

beetles, respectively.

A similar evaluation of the Quartz Creek area, further south on the Kenai Peninsula (Holsten 1996), showed 23% *Ips*-caused tree mortality over a seven year period. Accordingly, it was believed that the current mortality in the Granite Creek area would follow a similar trend. That is, *Ips*-caused tree mortality would continue at a low to moderate rate in the Granite Creek thinned areas for a few years but at a declining rate. Visual inspections in 1997 of the Granite Creek thinned areas, however, showed increasing *Ips* beetle activity. An average of 32% of the standing live residuals in the Granite Creek area were killed by *Ips* compared to an average 11% mortality in 1996 (Holsten 1997).

Semio-chemical trapping studies were also conducted in the Granite Creek area in the spring/summer of 1997. The results of these studies disclosed that racemic ipsdienol + cis-verbenol were the most effective pheromones in attracting dispersing beetles (Holsten 1997). Pheromones are chemical messengers that are utilized by *Ips* to initiate host selection and mass attack on spruce. One of these trapping studies was undertaken in the South-Side thinned area near Granite Creek. More than 13,000 adult *I. perturbatus* were collected in only five traps. *Ips*-caused tree mortality, however, was only 24% in the area where the pheromone traps were deployed vs. 40% in a similarly thinned area where no trapping occurred.

Based on the above results, there appeared to be a possibility of using the 2-component *Ips* attractant to trap-out dispersing *Ips* adults thereby significantly reducing tree mortality. Trap-out for *I. perturbatus* has been suggested and has undergone limited field testing in interior Alaska (Werner 1988).

## OBJECTIVES

- To evaluate a trap-out program using the *Ips* attractant pheromones: racemic Ipsdienol and cis-verbenol.
- To compare the commercially available pheromone attractants of *I. perturbatus* and *I. typographus*. If *I. perturbatus* responds in greater numbers to the *I. typographus* pheromone blend, these species maybe very similar taxonomically.
- To evaluate *I. perturbatus* population trends in the Granite Creek area.

## MATERIALS & METHODS

### *Trap-out*:

Six, one-acre circular plots were established in a thinned area located just to the east of the road leading into the Granite Creek Campground. The plots were spaced a minimum of 200' from one another on May 15, 1998 before *I. perturbatus* had begun their dispersal flight. All live and dead spruce greater than 1" dbh were checked and the following information recorded for each tree: dbh and tree condition (live or dead [beetle-kill]). Three plots were randomly selected to receive pheromone treatment. Pheromone treatment consisted of Lindgren funnel traps baited on May 15 with bubble cap formulations of racemic Ipsdienol and cis-verbenol. Each treated plot received seven traps (3 in the center of the plot and 1 trap/cardinal direction along the outer edge of the circular plot). The remaining three plots were left untreated and served as controls. All traps were emptied weekly and the number of *Ips* trapped were counted. In late August 1998, the six plots were re-visited and the number of trees recently attacked by *Ips* were recorded. This was done after the beetles had finished their dispersal flight as determined by the trap catches.

### *Comparative pheromone trapping study*:

As previously mentioned, *I. perturbatus* has been noted as being taxonomically similar to *I. typographus*. The attractant pheromone blend commonly used in Europe is similar to the one we use for *I. perturbatus*. In addition to the racemic Ipsdienol and cis-verbenol we currently use, methyl butenol is an important component of the *I. typographus* lure. In mid-May, before *Ips* dispersal flight had occurred, we placed 20 Lindgren funnel traps in a thinned spruce stand along the Seward Highway directly across from the entrance to the Granite Creek Campground. Traps were placed at least 100' apart. Four treatments were evaluated: (1) Empty traps served as checks; (2) racemic Ipsdienol + cis-verbenol bubble caps (Alaska *I. perturbatus* lure); (3) Ipslure (*I. typographus* lure commonly used in Europe containing racemic Ipsdienol, cis-verbenol + 1400 mg of methyl butenol); and (4) Ecolure, another *I. typographus* lure commonly used in Europe containing the same components as Ipslure. Each treatment was replicated 5 times and treatments were randomly assigned to the traps. *Ips* beetles were collected and counted weekly.

### *I. perturbatus population trends*:

Previous evaluations (Holsten 1996, 1997) utilized strip-cruises to determine *Ips* caused tree mortality and population trends. The three untreated 1-acre circular plots

used in the trap-out study were used to determine attack rates and possible population trends. Before *I. perturbatus* dispersal flight began, all spruce greater than 1" dbh were tallied as to diameter and tree condition (live & dead [beetle-kill]). These plots were re-visited after beetle flight terminated and the number of new *Ips* attacked trees by diameter was recorded.

## RESULTS & DISCUSSION

***Trap-out***:

*Ips* flight began around late May. Peak flight occurred towards the end of June. By mid-July, the *Ips* dispersal flight was over. Approximately 10,100 *Ips* adults were trapped in the 21 traps (av. 478 beetles/trap). This is in contrast to the more than 13,000 beetles trapped in only five traps in 1997; an indication of a declining population. The pheromone treated plots had an average *Ip*s-caused tree mortality of 2.3%; the untreated check plots sustained an average 3.6% attack rate. 50% of the newly attacked spruce in the pheromone treated areas were within 10-15' of the baited traps and may have occurred as a result of pheromone "spill-over" from the traps. It appears, however, that the *Ips* populations pressure in the study area was too low to determine if the trap-out procedure works.

***Comparative pheromone trapping study***:

There was a significant difference between the pheromone baited traps and un-baited check traps. No differences, however, were noted between pheromone treatments. The results are as follows: Check traps averaged 75 *Ips*/trap; racemic Ipsdienol + cis-verbenol baited traps averaged 329 *Ips*/trap; Ipslure baited traps averaged 395 *Ips*/trap; and Ecolure baited traps averaged 265 *Ips*/trap. The addition of methyl butenol did not increase *I. perturbatus* trap catches as it does with *I. typographus*. These results are similar to those obtained for *I. tridens* in a trapping study conducted in Canada (Moeck et al. 1985). Based on the Granite Creek trapping results, it appears that there are distinct responses to pheromone blends between the European and Alaska species thus validating the species distinctions.

***I. perturbatus* population trends**:

Previous *I. perturbatus* population trend surveys conducted in the Granite Creek area used strip-cruises. 1998 population trend surveys were based on the attack densities obtained from the three untreated circular plots used as checks in the trap-out study. As previously mentioned, an average of only **3.6%** of the live residual spruce were successfully attacked and killed in 1998 as compared to **32%** in 1997 and **11%** in 1996.

Thus, a total of **47%** of the residual spruce in the Granite Creek thinned areas were killed in a three-year period. It appears that the *Ips* population has declined and we can expect future declines next year. This is similar to findings from previous *Ips* outbreaks in interior Alaska (Holsten and Hard 1986). *Ips* activity reported near Bonanza Creek in 1984 (near Fairbanks), for example, where *Ips* populations built-up in broken tops in the summer of 1983. Heavy *Ips*-caused tree mortality was reported in 1984, declined in 1985, and was not apparent in 1986.

There appears to be two conditions necessary for rapid *Ips* build-up in standing live spruce. First, there needs to be a supply of breeding material. This can be fresh logging slash, broken tops, or in the Granite Creek example, heavy spruce beetle infestations. Trees recently infested by spruce beetles are quickly colonized by *Ips* beetles (Gobeil 1936). Second, conditions that "stress" uninfested standing spruce are important to sustain an outbreak. For example, the mid-1980's *Ips* outbreak near Fairbanks appears to have been "fueled" by abnormally low snow fall in 1985-86 which lead to drought-like conditions in the spring of 1986. This resulted in water-stressed spruce that became highly susceptible to successful attack by dispersing *Ips* beetles. Similar spring drought-like conditions apparently lead to the rapid increase in *Ips* activity in the Granite Creek area in 1996 (Holsten 1996). Once precipitation returns to "normal" as occurred in 1998 in the Granite Creek area, spruce are in a condition of favorable water balance and, thus, are more resistant to *Ips* attack. *Ips* populations thus decline.

The current increase in tree mortality in the Granite Creek area caused by *Ips* beetles is a reflection of the timing of forest health practices. By waiting until spruce beetle caused tree mortality is high in a stand, *Ips* populations likewise will be high, thus increasing the potential for additional tree mortality. Restoration should be the primary objective for any management activity in stands with high levels of bark beetle activity. Once beetle populations are high, the probability of successful prevention and mitigation tactics aimed at increasing forest health are greatly reduced. Early entries into a stand for forest health purposes will increase the options available to management thus increasing the probability of success.

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## APPENDIX A

ENGRAVER BEETLE
*Ips perturbatus* Eichh.

HOSTS: *Picea* spp.

DISTRIBUTION: Transcontinental in Canada; northern United States, and Alaska

DAMAGE: This species is usually not economically important because adults attack only weakened, windthrown, felled trees, and broken tops. Larvae feed beneath the bark consuming the phloem tissue. Larval feeding on standing trees can kill infested trees. However, when conditions are favorable, outbreaks can occur. More than 16,000 acres of *Ips* caused tree mortality occurred in the Fairbanks area in 1986. Likewise, border or residual trees can be infested within 1 to 2 years after clear-cutting or thinning of forest stands. Outbreaks are usually short-lived and subside after 3 years.

DESCRIPTION: Adults are small, (0.3-0.6 cm long) cylindrical, reddish brown, black beetles. The head is not visible when the insect is viewed from above. A distinguishing feature of all *Ips* is a pronounced declivity on the posterior end which is marginate with three to six pairs of tooth-like spines.

Larvae are segmented, soft-bodied, whitish, elongate, cylindrical, legless grubs. Head color is tan, and the thoracic segment is enlarged. Eggs are fragile, globular to ovoid in shape and translucently white. They are located in niches or grooves along the sides of egg galleries.

BIOLOGY: The life cycle of *I. perturbatus* is believe to be one generation annually in Alaska. The first evidence of *Ips* attack is fine, yellow-red boring dust in bark crevices or more commonly encountered on the top-side of down host material. Adults disperse to new host material during early May. Male *Ips* begin tree attacks and males and females are soon attracted via pheromones. *Ips* aggregate on selected hosts in response to male produced pheromones in the initial galleries. Two or more aggregating pheromones, along with host volatiles direct aggregation. Engravers prefer sunnier and drier host material than do spruce beetles. After boring into the bark, males construct an enlarged chamber in the inner bark

adjacent to the entrance hole. Adults construct egg galleries which radiate from the central chamber. These egg galleries are kept clear of frass and boring dust. Larvae bore outwards from the egg galleries.

SUPPRESSION: Preventive measures are the best suppression measure for *Ips* buildup. Preventing slash accumulation or burning infested *Ips* material help reduce engraver buildup. Direct control operations generally are not used against *Ips* as outbreaks develop and disappear rapidly.